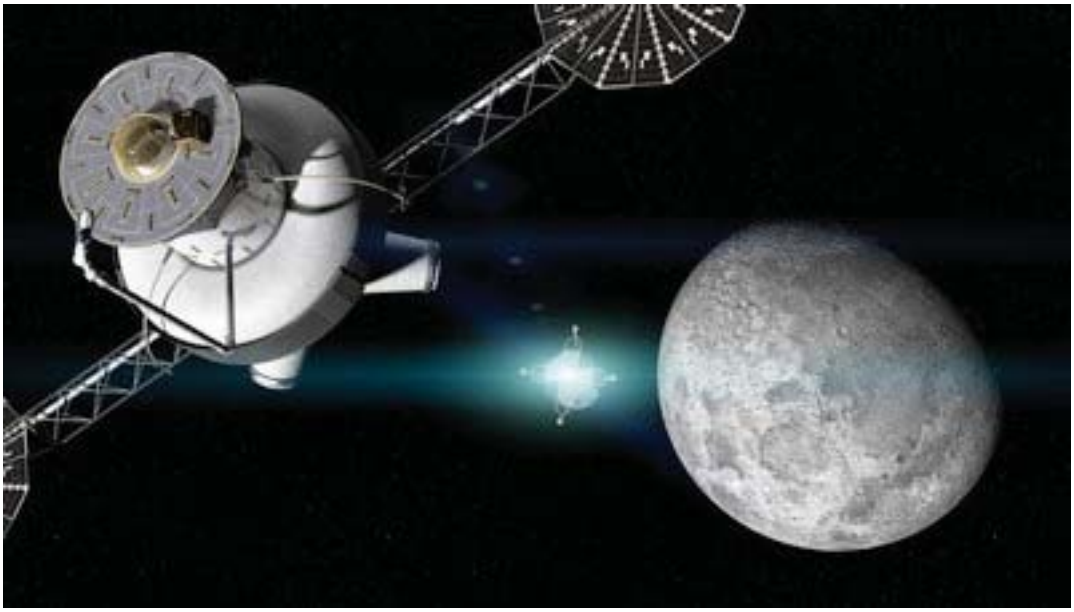

Concept developed in 2006 for a free-space habitation system proposed to NASA's Constellation Program to support human and robotic lunar surface exploration. (Courtesy: John Frassanito & Associates and the Future In-Space Operations Working Group)

Future In-Space Operations (FISO): a working group and community engagement

by Harley Thronson and Dan Lester

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Long-duration human capabilities beyond low Earth orbit (LEO), either in support of or as an alternative to lunar surface operations, have been assessed at least since the late 1960s. Over the next few months, we will present short histories of concepts for long-duration, free-space human habitation beyond LEO from the end of the Apollo program to the Decadal Planning Team (DPT)/NASA Exploration Team (NExT), which was active in 1999–2000 (see "Forging a vision: NASA's Decadal Planning Team and the origins of the Vision for Space Exploration", The Space Review, December 19, 2005). Here we summarize the brief existence of the Future In-Space Operations (FISO) working group in 2005–2006 and its successor, a telecon-based colloquium series, which we co-moderate.

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In January 2004, President Bush announced at NASA Headquarters his "Vision for Space Exploration" (VSE), which was followed almost immediately under the direction of NASA Administrator Sean O'Keefe by the development of architecture, concepts, and technology investment priorities for (primarily) human spaceflight beyond LEO. As part of this activity, a working group that we led obtained modest NASA Headquarters funding to assess how the evolving human spaceflight architecture could be used specifically for long-duration human operations in free space, both in support of a human return to the lunar surface, as well as a "stepping stone" for human missions beyond the Earth-Moon system. This formal group was dubbed the Future In-Space Operations Working Group (FISOWG). The FISOWG strategy explicitly built upon that developed years earlier under direction of Administrator Dan Goldin and the White House Office of Management and Budget by the DPT/NExT study effort.

Because of our professional backgrounds, activities of the FISOWG incorporated priority science goals, especially astrophysics, from the beginning. The engineering design and visualization company John Frassanito & Associates (JF&A) supported development of increasingly sophisticated concepts for long-duration habitation systems, usually at Earth-Moon L1 or L2. These venues provided opportunities for support for human lunar surface operations: communications hub, logistics and emergency medical services, telerobotic control over an entire lunar hemisphere, depot and re-supply sites, and so on, in addition to their value for in-space science.

When Michael Griffin replaced Sean O'Keefe as NASA Administrator in spring 2005, he created the Exploration Systems Architecture Study (ESAS) to develop a human spaceflight architecture consistent with the VSE. This offered an additional opportunity to incorporate human operations in free space as a priority. Both the recent FISOWG concepts and the half-decade-old DPT/NExT architecture were submitted to the ESAS team for their consideration, although they rejected a free-space human operation site at an Earth-Moon libration point. Similarly, the implementation of the ESAS studies, the Constellation Program, did not include substantive free-space operations, either in support of surface activities or as a "stepping stone" to very long-duration missions. The emphasis of the Constellation Program was on construction at, and development of long-duration human occupation of, the lunar south pole, whereas the emphasis of the DPT/NExT and FISOWG work was throughout cislunar space and beyond. Constellation management descried assessment of concepts for in-space operations with humans and robots as a "distraction" from its concentration on extensive lunar surface operations, and funding was no longer available to support free-space concept studies.

Unavailable funding is not synonymous with irrelevance. Most of the individuals inside and outside NASA who had been working on FISO concepts continued using their own resources, concepts, and operational scenarios became increasingly sophisticated, white papers and presentations were made, and small workshops were held.

The current FISO telecon colloquium series began as a simple opportunity for the FISOWG to have a weekly tag-up on Wednesday afternoons. In late 2006, we started using this opportunity to invite people doing relevant work to join in and summarize their work. Our goal was to educate and connect the FISOWG with relevant and topical activities outside our experience. Very soon, it became apparent that giving informal colloquia over the telephone, without the formality of Webex or even with video, was an effective strategy. It is true that the speaker cannot see the audience, and the audience can preview the whole presentation, but the speakers get used to that quickly, and questions can be raised effectively.

Without funding support, the FISO telecon colloquia became a somewhat extracurricular activity, and the telecon became less a working group tag-up and more, as it is exclusively now, an opportunity for a wide community to be presented with recent work relevant to in-space operations. It is important to understand that the FISO telecon, as it is now, is *not* a formal NASA activity: there is no NASA logo on our web pages. That being the case, we are able to set our own criteria for presentations. These presentations are co-chaired by a NASA employee, and the telecon uses a NASA toll-free line that is allocated to that co-chair for multiple uses. But other than that, the telecon has no formal connection with the agency. The website where the presentation materials reside is at the University of Texas with the second co-chair. That site was chosen long ago simply for administrative convenience, and an academic site is more accessible through industry firewalls than a commercial site.

The FISOWG itself, which used to be a dozen or so people with NASA-funded tasks, continues to expand somewhat organically to include what we refer to as "qualified participants," colleagues who have been working professionally in the topics covered by the telecons. This philosophy parallels that of academic colloquia where the audience is drawn from individuals with relevant expertise and interests. Our email notification list now numbers more than 350. People get on the invitation list simply by asking the co-chairs.

Understanding that these presentations are valuable to people who cannot participate at the scheduled time, we long ago put the slides from the presentations in a public archive. We note, for example, that Clark Lindsey, in his excellent and widely read HobbySpace blog has been reporting on these FISO presentations for some time, and directing people to our public archive.

Limiting the FISO telecon dial-in invitations was also motivated by our desire not to have too many people on the active telecon line at one time. As it is, we typically have about fifty people

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dialed in. It is our experience, in doing hundreds of such telecon presentations, that the more people we have on the active line, the more frequent are interruptions due to background noise. Although we ask people to mute their phones, we still sometimes hear kids screaming, dogs barking, frantic keyboarding, chairs creaking, airport public address announcements, telephone messaging announcements from abandoned phones, heavy breathing, and the occasional background conversation that several dozen people probably are not supposed to be hearing! Occasionally, static interference from a bad connection becomes so disruptive, we have to stand down and ask everyone to dial in again. It would be nice to have a listen-only telecon line that we can invite everyone to, but we have made our choices about this telecon colloquium series carefully.

To improve accessibility to our telecon series, two years ago we introduced audio recordings of the telecons, posting those recordings (including the questions) with the slides in our public archive. This recording is done in Texas, under Texas state telecommunications regulations. These recordings broaden the public outreach of our telecons, allowing anyone to podcast the presentations at their convenience. The presentations, including audio, are usually archived within an hour of the session. We have received multiple expressions of gratitude from both the invited community and the public for having this material conveniently available. You can "be there" within the hour, even if you were not there!

The wide availability of and unrestricted access to the FISO telecon presentations led to the need for care in establishing the content of the telecons, and in the responsibilities that we request of the participants and users of the materiel. We insist that presenters not include any ITAR-sensitive or potentially proprietary information. For presentations from industry, these presentations are formally reviewed and approved by management before they are given. We consider these presentations to be the intellectual property of the presenters in that, although they have given them to us to distribute publically, we request that materials used from the archive be credited to the presenter. On occasion, we have hosted presentations that have been criticized as controversial or in conflict with policies and priorities of an organization or interest group, or may generate "unwelcome" public debate about sensitive issues. In all these circumstances to date, we have stood by our personal philosophy that debate, discussion, and transparency are intrinsically valuable to the science and human space flight communities.

We are delighted at the response to these telecon presentations, and intend that they continue. Thus far, in the course of six years, we have had more than 130 of them, constituting an archive of more than three gigabytes. To the extent this over-the-phone presentation strategy can be duplicated for other subjects, it would be excellent. We look forward to constructive suggestions about these telecon colloquia and potential presentations.

Of course, we are most grateful to the excellent presenters and an audience that has never failed to participate with insightful and challenging questions.

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The authors, Harley Thronson and Dan Lester, are the co-chairs of the FISO telecon colloquium series. *The FISO telecon presentations were begun with the support and able assistance of Andrea Schweitzer and Giulio Varsi. We would like to thank all the speakers, over the years, for their excellent presentations, and their willingness to share their work and insights. Finally, we would like to thank Keith Cowing at NASA Watch for spurring the writing of this essay. His questions about the FISO telecon helped reveal some misconceptions about strategy and intent.*